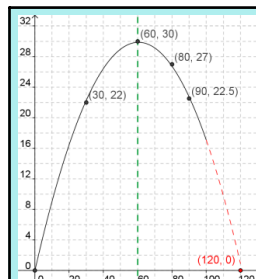
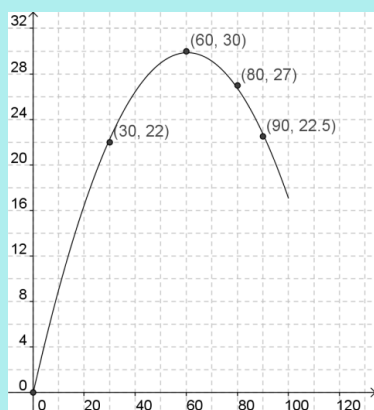


Data from the flight of a golf ball are graphed below. Identify key features that could be used to model the path using factored form or standard form.

$$y = a(x - s)(x - t) \quad y = ax^2 + bx + c$$



- one zero at (0, 0)
- y-intercept at (0, 0)
- max at (60, 30)
- axis of symmetry  $x = 60$
- other zero must be at (120, 0) by symmetry

standard  
 $y = ax^2 + bx + c$

factored  
 $y = a(x - s)(x - t)$

### L10(3.3) - Modelling Quadratics Using Factored and Standard Form

- 1) Sketch the parabola, if possible.
- 2) Identify the key properties given.
- 3) Use symmetry to deduce other key properties.
- 4) Select the equation based on key properties:  
factored form: at least one zero, two other points  
standard form: y-intercept, two other points
- 5) Substitute given information or points to solve for any missing values.
- 6) Does your answer make sense? Is there agreement with key features? Can you predict others?

Ex.1 Find the equation, in factored form, of the quadratic that passes through the points  $(-3, 0)$ ,  $(5, 0)$  and  $(7, 2)$ .

$$y = a(x - s)(x - t) \quad \leftarrow \text{Sub}$$

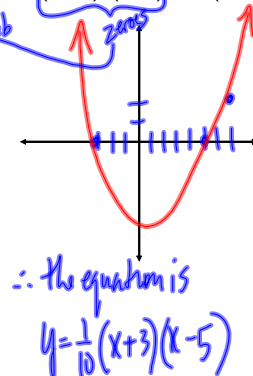
$$y = a(x + 3)(x - 5)$$

$$2 = a(7 + 3)(7 - 5)$$

$$2 = a(10)(2)$$

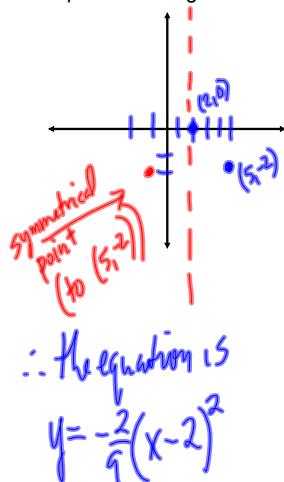
$$\frac{2}{20} = \frac{20a}{20}$$

$$a = \frac{1}{10}$$



Ex.2 Find the equation of the parabola, in factored form that has only one zero, which is 2, and that passes through the point (5, -2).

$$\begin{aligned}
 y &= a(x-s)(x-t) \\
 y &= a(x-2)(x-2) \\
 y &= a(x-2)^2 \\
 -2 &= a(5-2)^2 \\
 -2 &= a(3)^2 \\
 -2 &= 9a \\
 \frac{-2}{9} &= \frac{9a}{9} \\
 a &= \frac{-2}{9}
 \end{aligned}$$



Ex.3 A bird swoops from a branch 10 m above the ground. After 3 seconds it is 1 m above the grass, and then it flies to a perch in another tree. Assuming the path is *approximately parabolic*, model the flight of the bird in standard form.

$$y = ax^2 + bx + 10$$

$$(3, 1)$$

$$1 = a(3)^2 + b(3) + 10$$

$$-10 + 1 = 9a + 3b$$

$$\boxed{-9 = 9a + 3b} \times 2$$

$$(6, 10)$$

$$10 = a(6)^2 + b(6) + 10$$

$$10 - 10 = 36a + 6b$$

$$\boxed{0 = 36a + 6b}$$

$$-18 = 18a + 3b$$

$$18 = 18a$$

$$\frac{18}{18} = \frac{18a}{18}$$

$$\text{Sub } a = \text{into}$$

$$-9 = 9(1)$$

$$-18 = 3b$$

$$\frac{-18}{3} = \frac{3b}{3}$$

$$b = -6$$

∴ the equation is  $y = x^2 - 6x + 10$   $a = 1$

Sub  $a = \text{into}$   
 $-9 = 9(1)$   
 $-18 = 3b$   
 $\frac{-18}{3} = \frac{3b}{3}$   
 $b = -6$

Assigned Work:

p.175 # 1, 2, 4, 6, 9ab, 11, 15\*